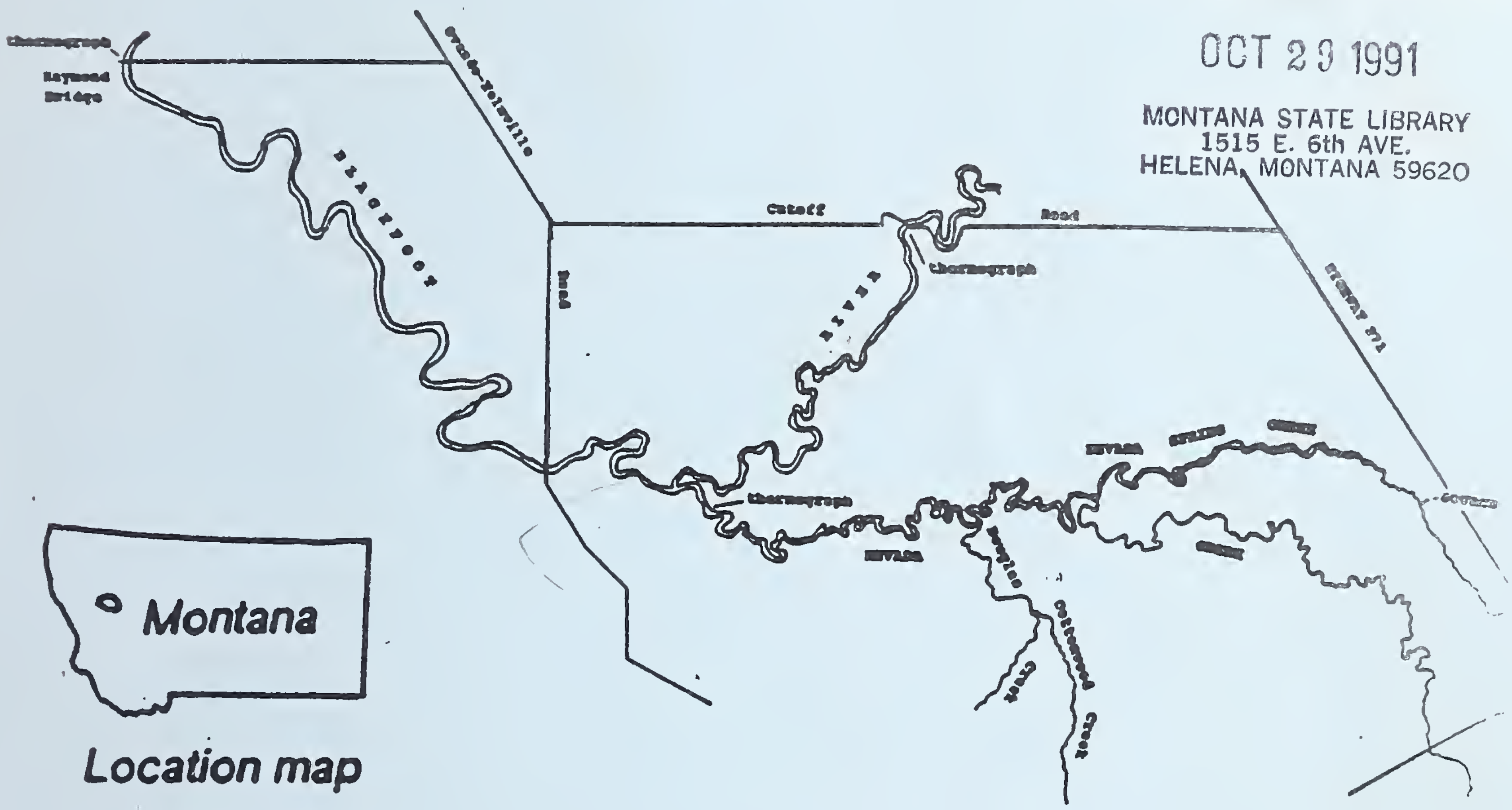
AQUATIC INVESTIGATIONS IN THE MIDDLE BLACKFOOT RIVER NEVADA CREEK AND NEVADA SPRING CREEK CORRIDOR



PREPARED

BY

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EXECUTIVE SUMMARY
AQUATIC INVESTIGATION IN THE MIDDLE BLACKFOOT RIVER, NEVADA CREEK AND NEVADA SPRING CREEK

Low water quality, poor habitat and environmental stress impact the aquatic system in Nevada Creek and the Blackfoot River below its confluence with Nevada Creek.

Studies show that the middle reach of the Blackfoot River and Nevada Creek support severely depressed fisheries. Nevada Creek provides an exceptionally harsh environment for trout.

Of 13 tributaries, Nevada Creek was the third highest contributor of suspended sediment to the Blackfoot River. Nevada Creek was a major source of bioavailable nutrients during runoff. Total phosphorus and nitrogen levels were higher in Nevada Creek than any other tributary.

Nevada Creek discharges warm water into the Blackfoot River during summer and early fall. Stream temperatures in the Blackfoot River below Nevada Creek were significantly higher than stream temperatures upstream from Nevada Creek. Summer water temperatures in Nevada Creek and the Blackfoot River downstream from Nevada Creek were consistently above levels considered optimal for trout. The presence of noxious densities of filamentous green algae and/or rooted aquatic plants in Nevada Creek and the Blackfoot River downstream to the confluence of the North Fork probably result from the elevated nutrients and water temperatures from Nevada Creek.

Fish habitat in poor condition, poor water quality and barriers to good spawning areas severely lower current fishery values in Nevada Creek and the Blackfoot River in this middle reach.

Low water quality, poor habitats and depressed fisheries in Nevada Creek and to some degree the Blackfoot River below Nevada Creek can be attributed to agricultural practices in the Nevada and Ovando Valleys. Alteration of stream flows below Nevada Creek Reservoir including dewatering of the stream channel even for short periods can eliminate viable trout fisheries. Irrigation return flows can add excessive amounts of nutrients, sediment and increase water temperatures. Uncontrolled grazing practices in riparian areas: 1) reduces bank vegetation and shade; 2) increases levels of sediment and nutrients to the stream; 3) elevates water temperatures; 4) creates wide, shallow and silted stream channels; and 5) causes the destruction of fish habitats.

Corrective measures could improve water quality and fisheries in the Nevada Creek Basin. Corrective measures could include: 1) stream-side land management improvement that protect stream corridors; 2) deeper and therefore cooler reservoir releases; 3) more water in the channel at critical times (midsummer when temperatures are elevated); 4) and stream rehabilitation projects. A program that includes the water needs of the fishery resource could be arranged with current water users and acceptable solutions developed. Such practices as improving ditch delivery systems, water leasing, and others may be acceptable to obtain better instream flows. Managed grazing

practices like rest-rotation would improve bank stability. The condition of Nevada Creek and its potential for improvement warrants the investigation of these and perhaps other stream improvement projects. Sources of project funding could come from state or federal natural resource agencies and/or private groups like Trout Unlimited or Ducks Unlimited. Stream habitat restoration projects have begun near the source of Nevada Spring Creek in 1990.

Nevada Spring Creek source area was identified as having high potential for improved trout spawning opportunity. So in the spring of 1990 a habitat restoration plan was developed. The 1990 stream restoration project included: 1) fencing the stream corridor to restrict livestock impacts; 2) willow plantings that will stabilize banks, provide much needed security-cover and shade to the stream; 3) installation of logs and woody debris to enhance security cover for both adult and juvenile fish until natural vegetation is reestablished; and, 4) reintroduction of juvenile westslope cutthroat trout. The main importance of this project was the protection of the source of cold, clean, high quality water and improve crucial spawning habitat for resident and possibly migratory trout.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

The health of the Blackfoot River fishery is largely a function of the contribution of tributary streams. The completion of life-cycles for most species of trout in the Blackfoot River require tributaries. Tributaries provide not only spawning gravels for migratory fish but also provide rearing habitats for young fish before they move downstream and into the river. To perform these functions tributaries need a combination of high quality habitats and access to these habitats if migratory Blackfoot River fish and resident tributary fisheries are to persist at optimal levels. Trout populations in the Blackfoot River between Nevada Creek and the North Fork appear to have potential for significant recovery with improved recruitment.

Nevada Creek could link migratory river fish, rainbow, cutthroat and possibly brown trout with spawning gravels in the tributary network, and provide recruitment to a river section that severely need it. Long-term residents of the Nevada Creek area have given accounts of a thriving fishery in the past. However, Nevada Creek in its existing condition supports only a small fraction of its potential. It has potential for greatly improved fisheries due to its biogeographical relationship with the river and its potential for improved fish habitat.

The mouth of Nevada Creek is located at a major break in the Blackfoot River profile. Upstream from the mouth of Nevada

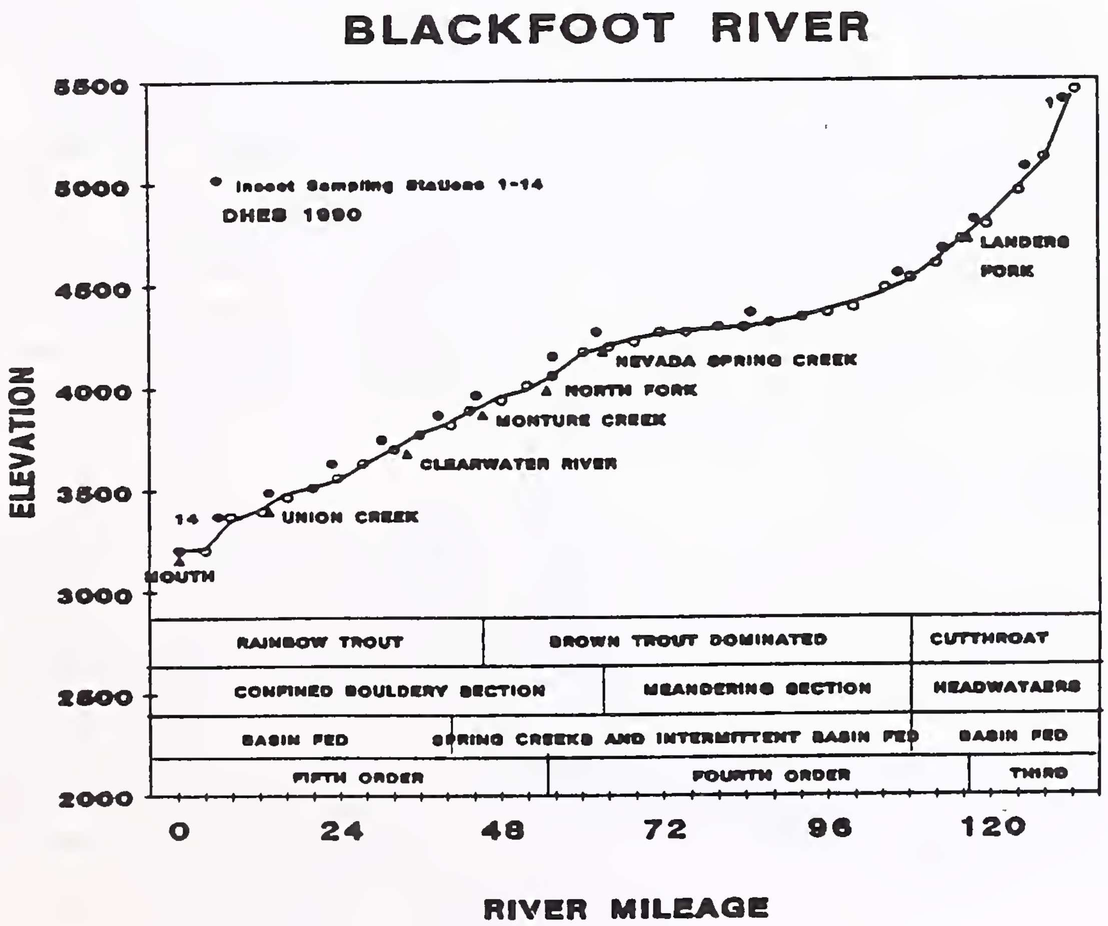


Figure 1. Blackfoot River profile of trout species, channel and basin features.

Creek, the Blackfoot is slow moving, low in gradient and supports a brown trout fishery. Downstream from the mouth of Nevada Creek, the Blackfoot is much faster with a much higher gradient and supports a mixed fishery of brown, rainbow and cutthroat trout. Poor spawning gravels in the river and the lack of spawning opportunity in tributary streams limit reproduction and therefore the numbers of fish in this reach of the Blackfoot River. Nevada Creek has great potential for providing additional recruitment to this recruitment-limited river section.

THE BLACKFOOT RIVER BETWEEN LINCOLN AND THE NORTH FORK

The Blackfoot River above Nevada Creek follows a tightly meandering course through flat outwash plains; it maintains a low gradient (4 ft/mile) profile in a channel comprised of fine alluvial substrates. Fish habitat is provided by deep pools and large woody debris in the channel. Below Nevada Creek, the river becomes entrenched, confined by moraine against the foothills of the Garnet Mountains. Once confined, meandering decreases and stream gradient increases from 4 to 16 feet-per-mile (range 15-20). Deep pools and scattered glacial boulders provide the bulk of instream cover. Stronger more variable currents support a mixed yet very depressed fishery. In western Montana, larger, faster streams like this usually support rainbow and cutthroat trout which are better adapted to these conditions than brown trout. However, brown trout dominate while rainbow and cutthroat trout inhabit this reach in extremely low numbers. A combination of negative impacts: increased sediment, increased nutrient concentrations, and elevated stream temperatures diminish instream habitat in the Blackfoot downstream from Nevada Creek. The limited number of tributary streams in the reach provide only limited spawning opportunity resulting in poor recruitment. In addition low recruitment can also be attributed to poor water quality, restricted access and limited availability of spawning gravels in the tributary network.

NEVADA CREEK BASIN

Nevada Creek drains a 3rd-order basin into the Blackfoot River at river mile 67.8. Nevada Creek flows for 52 miles with an average gradient of 48 feet/mile (figure 2). It drains montane mountain slopes, rolling prairie foothills and agriculturally dominated bottomlands. Nevada Creek begins on the western slopes of the Continental Divide. It flows SW for eight miles with a gradient of 320 feet-per-mile until it reaches the upper Avon Valley. It bends NW from there and continues through agricultural ranchlands and low rolling prairie foothills of the Garnet Mountains. It receives water from several small (1st and 2nd-order) perennial prairie streams. At stream mile 35, the Garnet Mountains converge and confine Nevada creek to a narrow valley (1/4-1/2 mile wide) where it empties into Nevada Reservoir. Just before entering Nevada Reservoir, the stream maintains a gradient of 40 ft/mile, an average flow of 37.1 cfs (figure 3) and a base flow of about 12-15 cfs (USGS 1989).

Nevada Reservoir is formed from an earthfill dam with a concrete spillway used for irrigation and recreation. It was built in 1938 to supply the pasture and haylands in the lower Nevada Valley with a perennial supply of irrigation and stock water. It has a maximum usable capacity of 12,640 acre-feet between elevation 4551.5 ft (bottom of outlet), and the spillway crest located at an elevation of 4,616.0 ft. Dead storage is 12 acre-ft below elevation 4,551.5. Extremes for period of record are: maximum volume observed, 13,520 acre-ft, June 3 1953, elevation 4618.3 ft; and no storage Aug. 14 to Oct. 31, 1973, Sept. 15, 1988. On average the reservoir has 66% chance of reaching its useable capacity in a given year. Based on 24 years of record, maximum capacity obtained averages 91% of useable storage (USGS 1989).

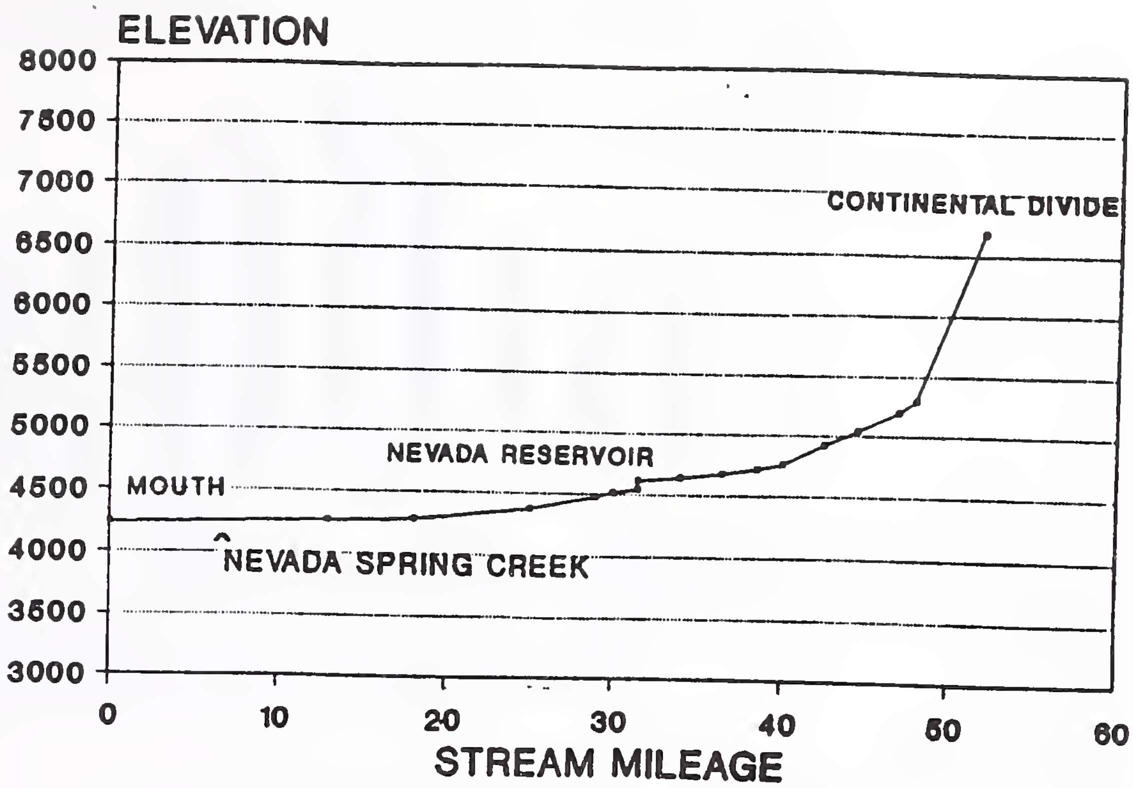


Figure 2. Nevada Creek Profile.

During the drought of 1988, the reservoir dried to a mud flat. This reportedly devastated fisheries as previously stored water was quickly allocated and used. The local water board now tries to maintain 6,000 acre feet of winter storage with winter releases of 7.5 cfs. This 6,000 acre feet storage is up from 3,500 acre feet (figure 4). This increase in storage is insurance against drought and low runoff (Glen Ballard, dam operator, pers. comm. Oct. 1989).

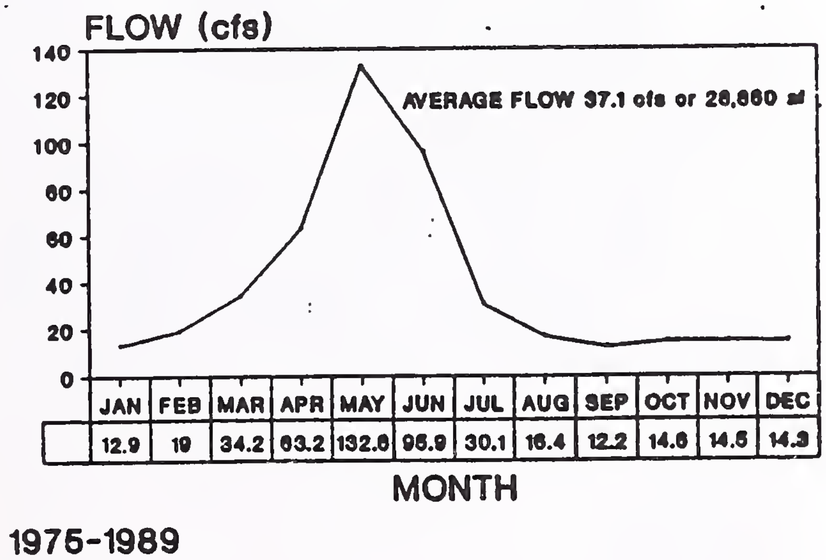


Figure 3. Average flow for Nevada Creek above the reservoir.

At the request of the Nevada Creek water users the Montana Dept. of Fish, Wildlife and Parks conducted wetted perimeter (WETP) analysis on Nevada Creek downstream from Nevada

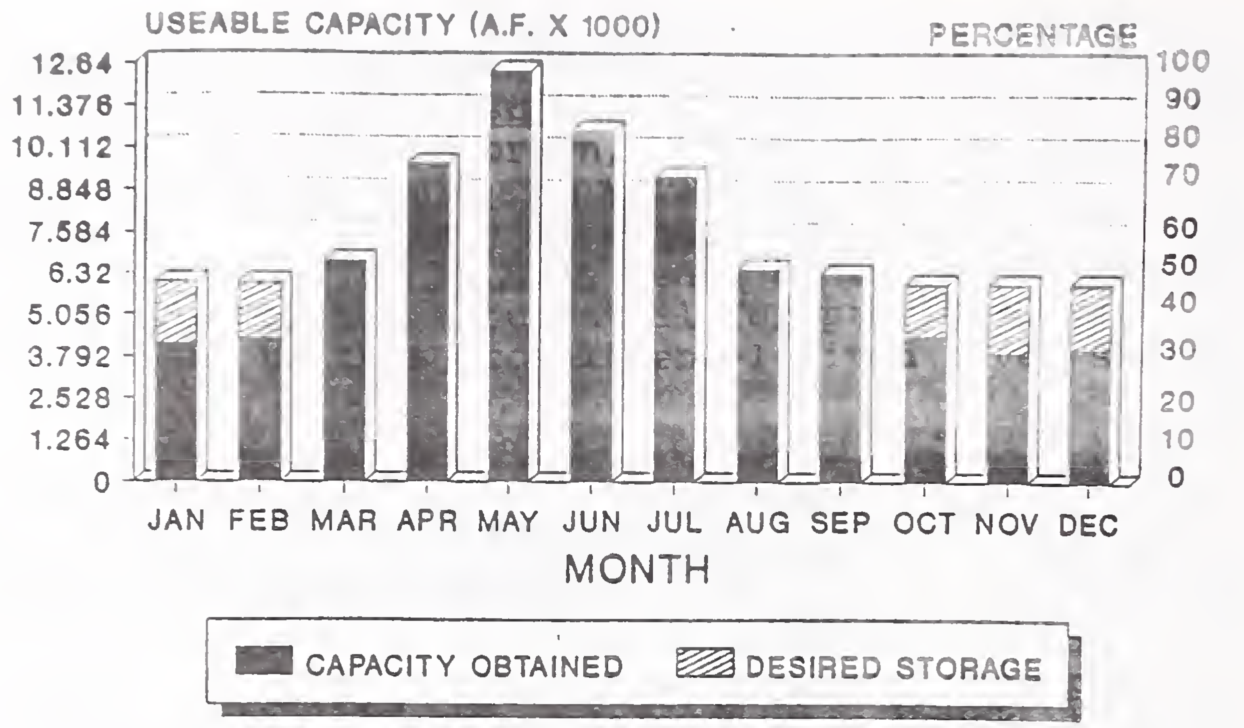


Figure 4. Useable storage capacity obtained in Nevada Rervoir, mean values 1974-1990.

Lake in 1987 and 1988. The WETP analysis is a standard method for identifying minimum flow required to maintain a fishery. The results of the analysis indicates that an instream flow of 40 cfs should maintain a high level of aquatic habitat potential for Nevada Creek downstream of Nevada Lake. An instream flow of 12 cfs should maintain a low level of aquatic habitat potential. One problem with this is that there is a major diversion downstream from where the WETP analysis was conducted. Therefore it may be necessary to maintain flows above the diversion at high levels in order to maintain the desired level of aquatic habitat potential below the diversion.

Current regulation of Nevada Reservoir varies depending upon reservoir storage and irrigation need. According to the water discharge measurements (1966-1990), discharge is curtailed usually in July during the haying season when irrigation demand is reduced. Discharge is reduced to 0.0 cfs one of every three years during summer months on average (DNRC 1990). The outlet of Nevada Creek reservoir is at mile 31.7. At stream mile 28.5, the Douglas Creek canal diverts water from Nevada Creek. Based on records from 1966-1990, the Douglas canal diverts on average 8,120 acre-feet of water during the irrigation season (DNRC 1990). For the 1990 period of record (4/20 to 10/10), the Douglas Canal diverted a total of 27% of Nevada Creek flow (figure 5). From July, through September, diversionary withdrawal increased to an average of 56% of the Nevada Creek discharge, and diverted as much as 94% for a brief period in July (DNRC 1990). The Douglas canal takes this water along the flanks of the foothills and delivers water to benches and irrigated pastureland along the southern portion of the Nevada Valley. The canal joins Cottonwood creek and finally Douglas Creek which empties back into lower Nevada Creek at stream mile 4.4.

The North Helmville Canal diverts water at mile 27. According to the DNRC (1990), this canal diverts significantly less water than the Douglas canal. There are no records of volume.

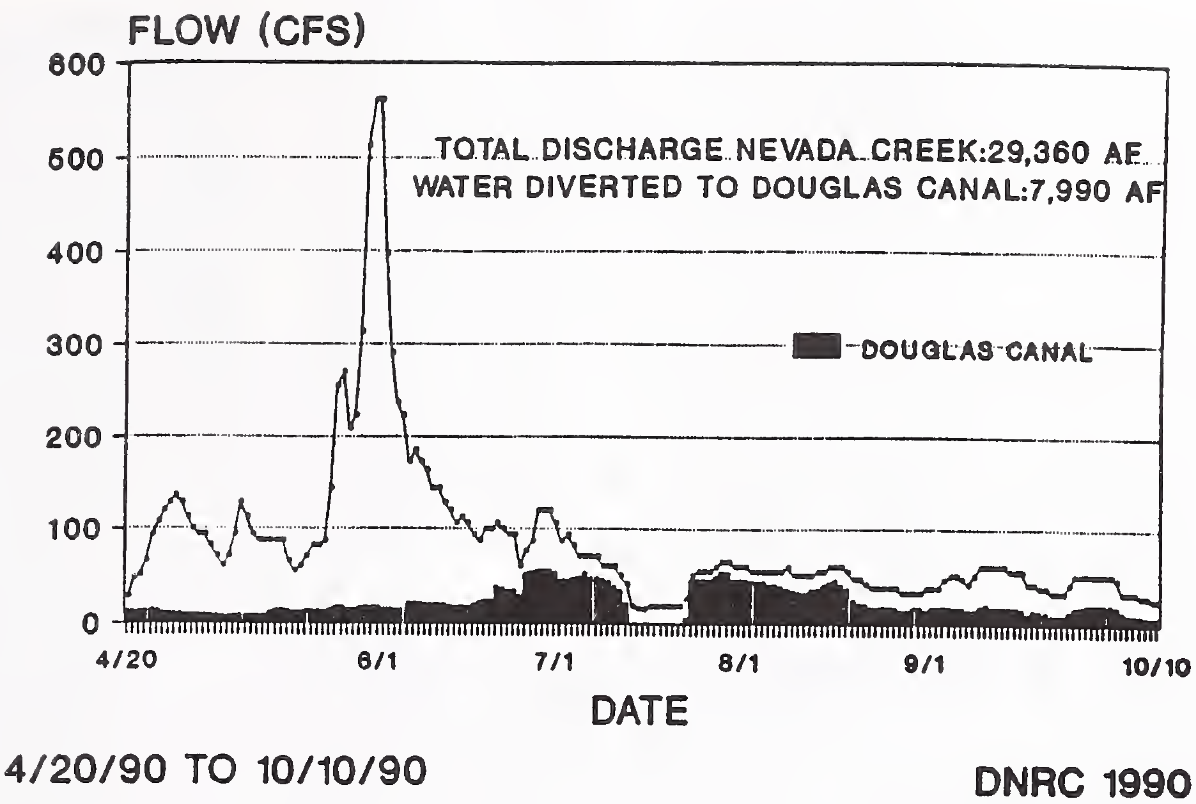


Figure 5. Discharge from Nevada Reservoir and diversion to Douglas Canal.

The diversion skirts the prairie foothills along the northern portion of the Nevada Valley. It follows a NW course until it reaches the Blackfoot River floodplain in the upper Ovando Valley.

At about stream mile 25, the mountains gradually separate to form the Nevada Valley. As the Nevada Valley widens, prairie foothills replace prairie parkland and timbered mountain slopes. Stream gradient gradually drops to a low 4 ft/mile. With decreasing gradient, the stream becomes very sinuous and flows through flat pasturelands and riparian wetlands. The southern foothills attenuate to smooth alluvial plains as the Nevada Valley joins the larger Ovando Valley. Small turbid tributaries enter Nevada Creek from surrounding ranchlands and combine with irrigation return water. The low-gradient stream continuously picks up sediment and nutrients as it flows through the pasturelands. At stream mile 6.5, Nevada Spring Creek joins Nevada Creek. At this junction both are turbid with elevated water temperatures and nutrient enriched with high densities of rooted aquatic plants. Nevada Creek continues for another 6.5 miles to its confluence with the Blackfoot river. Discharge was measured at 43.8 cfs (11/1/89) and 32.2 cfs (8/27/90).

NEVADA SPRING CREEK

Most spring creeks in the middle and upper Blackfoot Valley drain gravel aquifers from within flat glacial outwash plains located near the center of the Blackfoot Valley. Unlike the more common spring creek, Nevada Spring creek is a unique spring creek

for the Blackfoot Valley. Nevada Spring creek surfaces from a single source artisian aquifer. A constant 11 cfs bubbles from the source located at the lower slopes of morainal foothills. During the summer 1990, temperature was constant at 44-45 degrees F. Dissolved oxygen was measured at 7.8 parts-per-million. This is equivalent to 75 percent of saturation at the 4,300 foot elevation and at this water temperature. Of the 11 cfs, 4 cfs is diverted at the source to pasturelands in the valley or into the Wasson Creek. Wasson Creek then returns water back to the spring creek just below its source. The other 7 cfs tumbles down the stony hillslope. At the Wassan Creek junction, 200 feet below the source, Nevada Spring Creek enters the smooth alluvial plains of the lower Nevada Valley. Once the stream enters the plain, gradient quickly drops to about 4 feet-per-mile. The stream flows for 3.2 miles to its confluence with Nevada Creek.

Except for a few patches of willow and aspen near the source, livestock have eliminated nearly all woody riparian vegetation. The stream becomes wide, shallow and heavily silted due not only to erosion caused by unrestricted livestock use but also to rock dams used for flood irrigation which trap sediment. The stream receives direct sunlight, elevating stream temperatures and increasing the ability of the stream to grow aquatic vegetation. Because of these and possibly other negative influences, habitat quality progressively decreases downstream.

WATER QUALITY STUDIES:SEDIMENT

NEVADA CREEK

Of 13 tributaries tested for suspended sediment by the State Water Quality Bureau, Nevada Creek was ranked as the third most important contributor of sediment (60 mg/l) to the Blackfoot River during the runoff period 1989 (DHES, 1990). Concentrations in the North Fork and the Landers Fork were greater than Nevada Creek possibly due to the exposed soils resulting from the 1988 Canyon Creek fire.

NEVADA SPRING CREEK

Streams in the area have relatively higher natural sediment loads owing in part to its meandering nature and fine erosive soils. These streams tend to be more susceptible to human-induced sediment related impacts. Impoundments and a history of livestock management practices that are not sensitive to stream bank conditions increase erosion and contribute to sediment deposition.

As part of a stream habitat evaluation, fishery crews collected samples of stream bottom substrate composition from the spring source to the confluence. In the first half-mile of stream, fine sediments (sand and silt) comprised 79 percent of the substrate, followed by 20 percent gravel and 1 percent cobbles. Over the rest of the streams course, fine sediment comprised over 99 percent of the substrate composition. The

habitat crew noted that deteriorating habitat quality resulted in inadequate pools, increased turbidity and excessive siltation. Trampled and raw banks are the primary sources of eroded material; whereas, rock dams and culverts are primary causes of sediment deposition (figure 7). From a dam and culvert structure at (stream mile 0.7), sediment covers the stream bottom to a depth ranging from 25-90 cm, and averages 49 cm upstream of the culvert. Even at base flow, the culvert acts as an impoundment device (figure 6). Below the culvert sediment depth ranges from 20 to 60 cm.

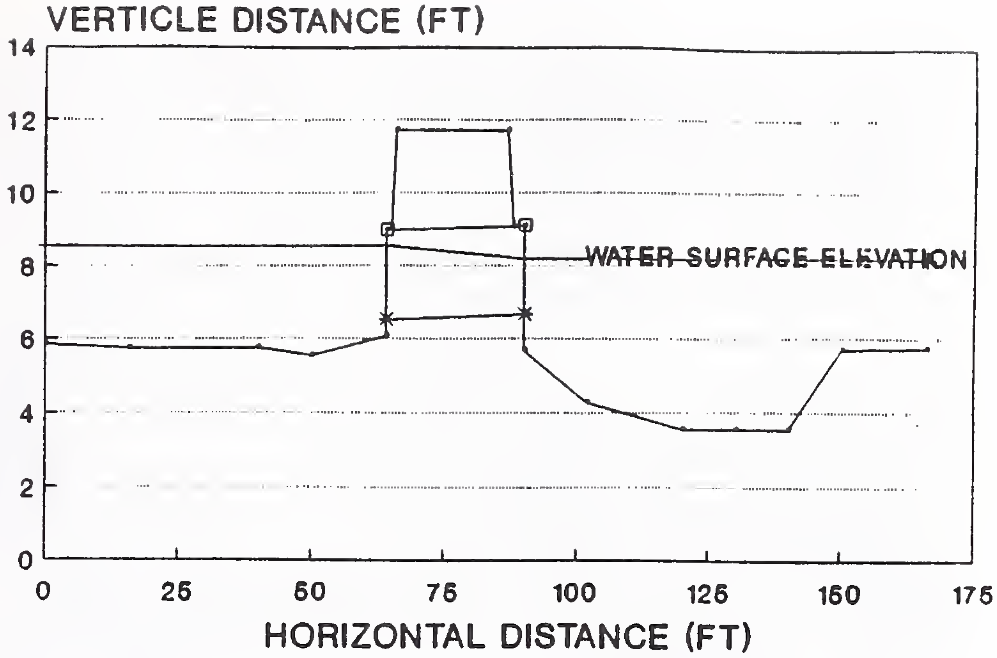


Figure 6. Longitudinal stream profile above and below the culvert.

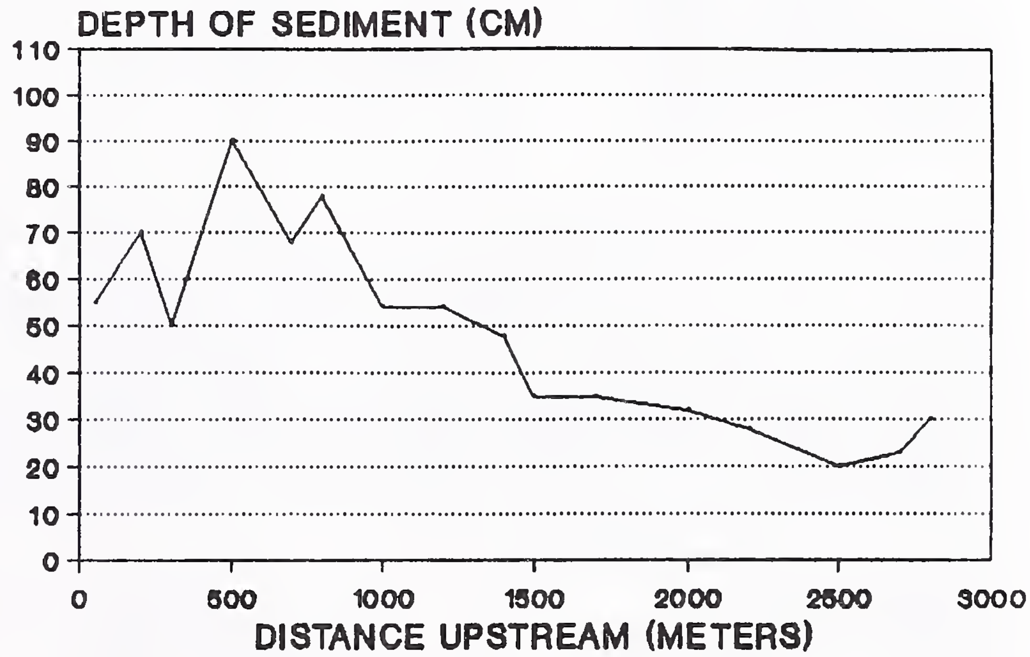


Figure 7. Depth of sediment in Nevada Spring Creek above the culvert.

Significant increases in sediment impacts the ecological and biological integrity of stream ecosystems by: 1)reducing light penetration and therefore photosynthesis; 2) elevating stream temperatures by increasing the absorption of solar energy; 3) causing abrasion or clogging gills of fish or invertebrate organisms; 4) reducing infiltration of oxygenated water through gravel and thereby smothering developing eggs or alevins in stream gravels; and 5) reduce insect habitat and therefore reduce fish food organisms. Spring creeks are more susceptible to sediment impacts than basin-fed streams because without flushing flows associated with basin snow melt sediment accumulates in the channel.

NUTRIENT STUDIES

The DHES (1990) tested several tributaries for phosphorus and total nitrogen concentrations during the runoff period in 1989. Several streams had elevated phosphorus levels: however,

only Nevada Creek exceeded the total phosphorous criterion of 100 ug/l by a substantial margin (figure 8). Nitrogen concentration in Nevada Creek were very elevated when compared to the 13 other tributaries sampled (figure 9). These elevated nutrients indicate agricultural runoff enriched with fertilizer, soil particles and animal wastes (DHES, 1990).

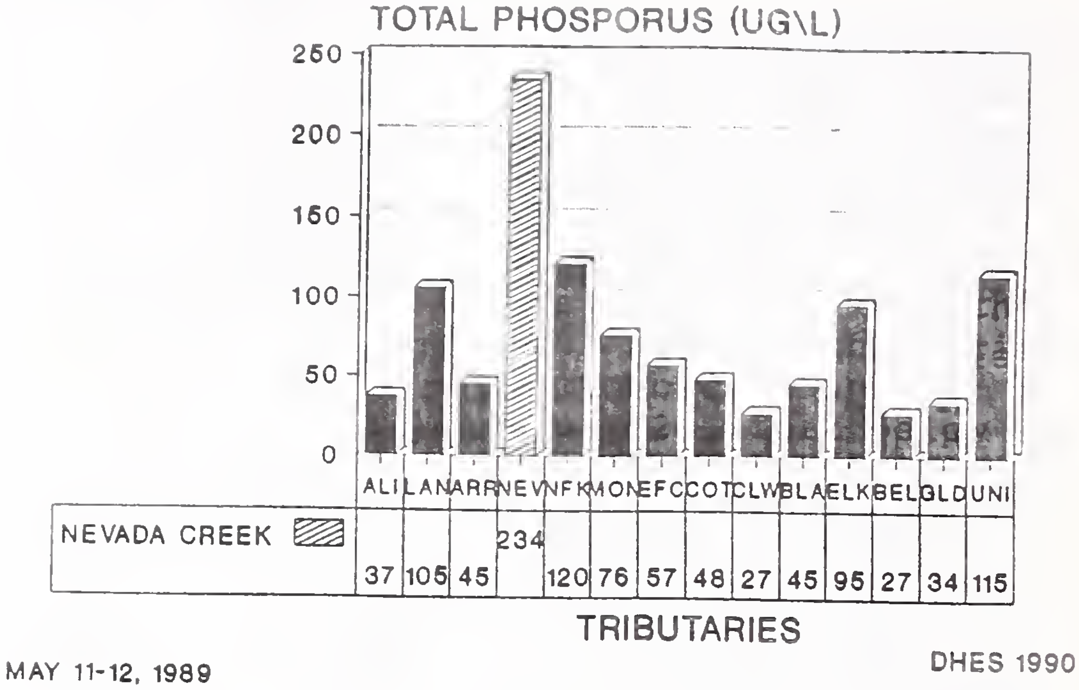


Figure 8. Tributary phosphorus concentrations.

Water quality samples taken by the fisheries crew in Nevada Spring Creek indicate the spring creek to be a source of phosphorus and nitrogen. Total phosphorus at the source was 0.047 parts-per-million (ppm) and 0.062 ppm three miles below the source. Total KJL nitrogen, measured at 0.01 ppm at the source increased to 0.9 ppm three miles below the source. Total nitrogen ($NO_3 + NO_2$) was <0.01 ppm at the source and 0.24 ppm at the homestead.

Limited nutrient input into the stream may be beneficial; however, continuous enrichment of organic pollutants from agricultural lands leads to undesirable changes in the stream ecosystem. One undesirable feature of nutrient enrichment is a change in flora, generally to blooms of algae or macrophytes. Nitrogen and phosphorus are the two most important stimulants of growth (Provasoli, 1969). The dense growths of green algae and/or rooted aquatic plants in both Nevada Creek and the

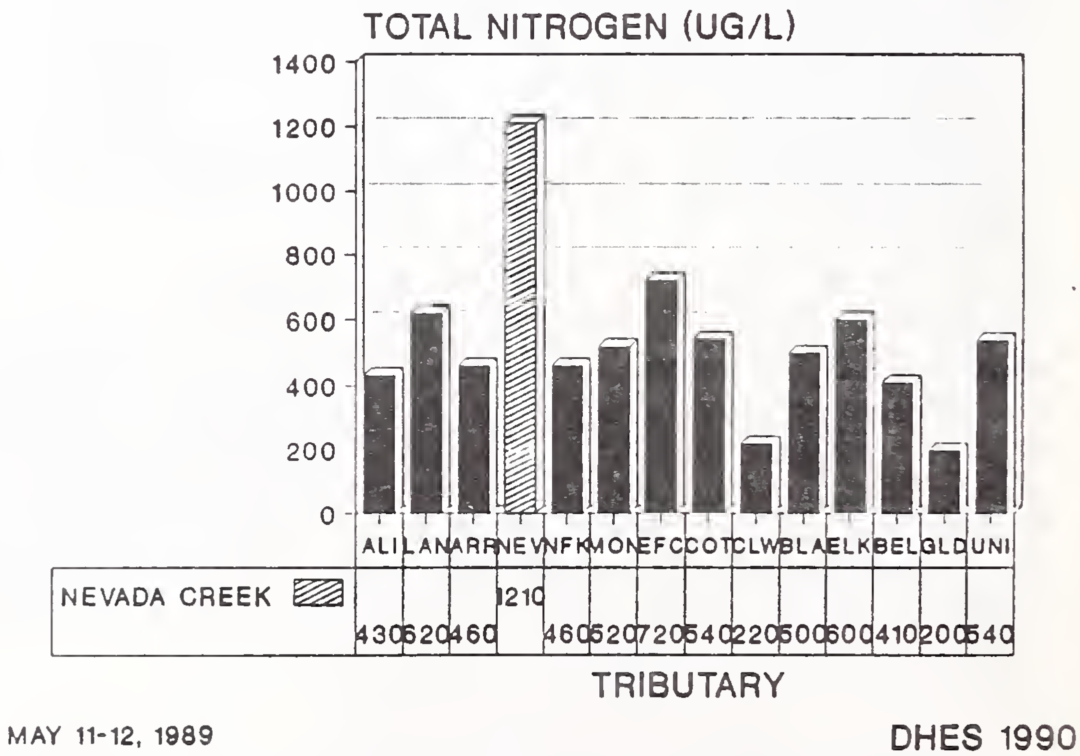


Figure 9. Tributary nitrogen concentrations.

Blackfoot River downstream from Nevada Creek probably result from the elevated nutrient levels. A further complication to the health of the aquatic system is the depletion of dissolved oxygen in the water. Because water receives much of its oxygen from the atmosphere through turbulence, slow moving streams receive less oxygen than turbulent stream. During daylight, plants and algae releases oxygen to the water and compensates for slow diffusion of atmospheric oxygen. However, sometimes with excessive growths of algae or other aquatic plants supersaturation of oxygen occurs during daylight hours. That is a condition in which more dissolved oxygen occurs in the water than would naturally occur at the particular elevation and water temperature. Oxygen supersaturation puts additional stress on the aquatic organisms. At night photosynthesis stops and so does the production of oxygen. Meanwhile decay and respiration of the aquatic plants uses dissolved oxygen. At low flows or in dewatered streams, rotting/respiring plants can reduce a small stream's oxygen supply. Warm water streams are particularly susceptible to oxygen depletion because oxygen storage capacity decreases with increasing temperature. In extreme cases nutrient enrichment and low oxygen favor the propagation of suckers and squawfish or other "rough" fish that have lower oxygen requirements than trout.

BIOTIC INDEXES OF WATER QUALITY

THE BLACKFOOT RIVER

Percent relative abundance of filter feeding insects provide insights into organic pollutants and toxic conditions. Filter feeders are a major component (20 - 50%) of insect fauna in most large rivers during the summer. Relative abundance greater that 50% indicate high algal densities usually associated with organic nutrient enrichment. The mean relative abundance of filter feeding macroinvertebrates for all combined Blackfoot River stations was 37 percent (DHES 1990). Filter-feeders comprised less that 10 percent at the upriver control site, yet comprised between 60 to 70 percent of the insect fauna in the river downstream from Nevada Creek. The

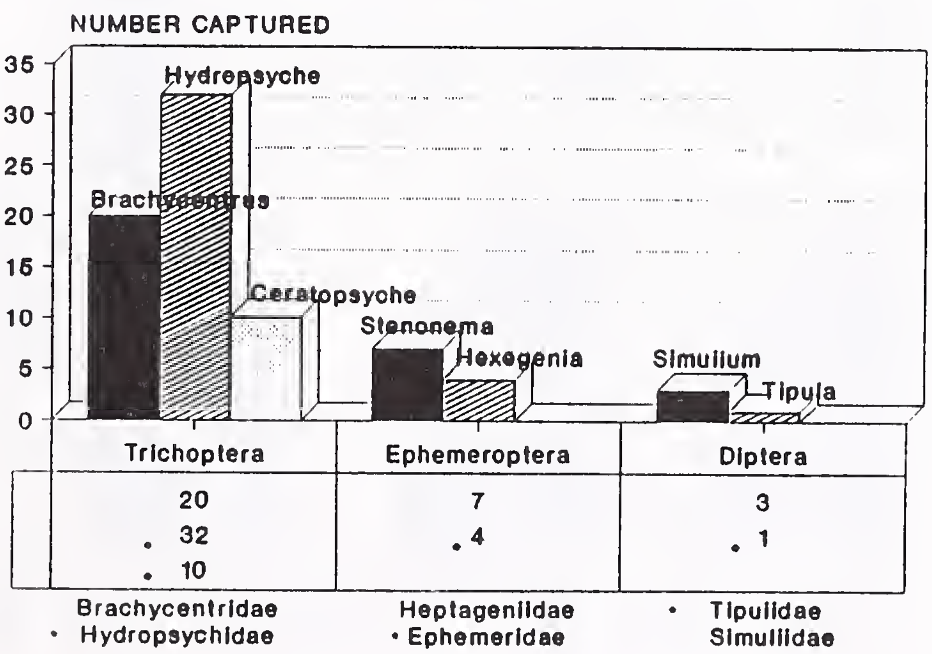


Figure 10. Insect fauna collected near the mouth of Nevada Creek, October 1990.

dominant taxa (Hydropsyche occidenalis and Simulium) are filter feeders commonly associated with relatively high water temperatures and elevated nutrient levels. Additional insect studies, based on the relative abundance of dominant taxa, indicated light or moderate stress in the river downstream from Nevada Creek (DHES, 1990).

NEVADA CREEK

We collected insect samples in riffle habitats near the mouth on Nevada Creek (stream mile 0.7) as well as three sites on Nevada Spring Creek. The Nevada Creek sample had the highest density of caddisfly filter-feeders of the four collection sites. The genera Hydropsyche, Ceratopsyche, Brachycentrus were present in the sample. Brachycentrus is adapted to reduced oxygen levels. Mayfly species intolerant to low oxygen or organic pollutants that inhabit the spring creek were absent as were other oxygen and pollution sensitive insects like stoneflies.

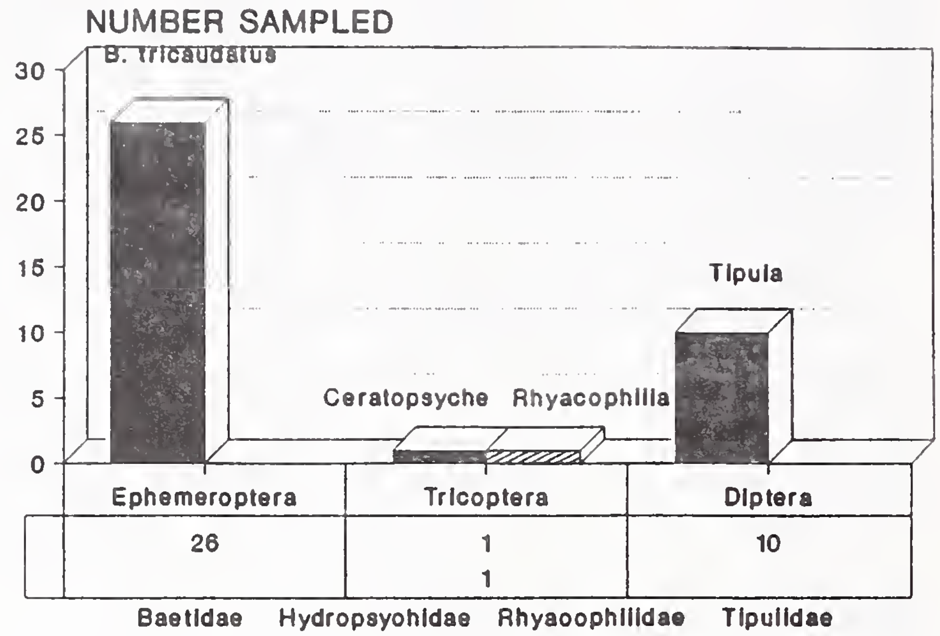


Figure 11. Insect fauna collected at the Nevada Spring Creek source, October 1989.

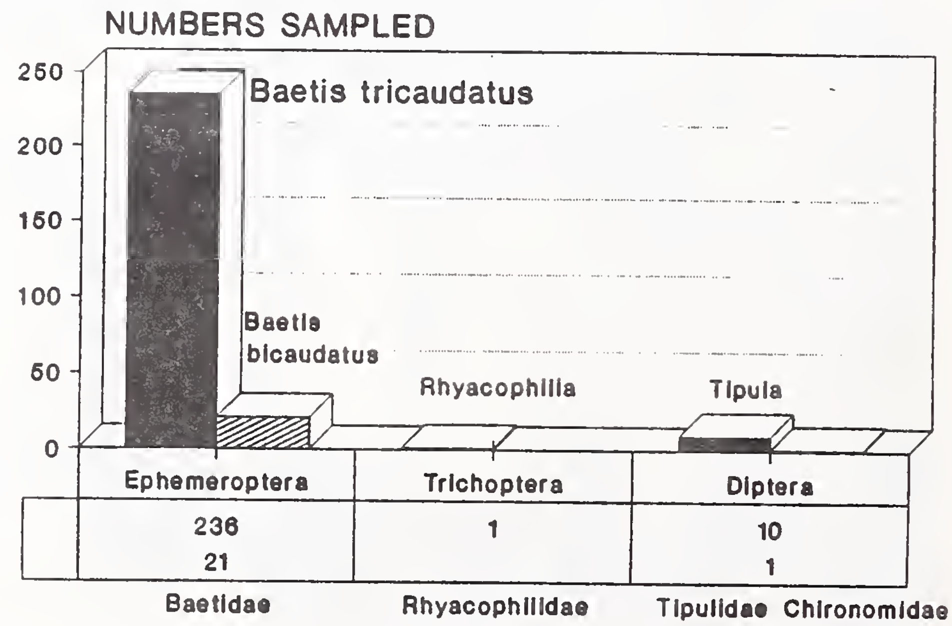


Figure 12. Insect fauna collected 200 feet below the spring source, October 1990.

NEVADA SPRING CREEK

Three insect samples collected in November 1990 in the spring source area had a low diversity of aquatic insects. Low species diversity or richness is typical of very stable or polluted environments. The source area does however maintain high mayfly densities. Two mayfly species (Baetis bicaudatus, Baetis tricaudatus) dominated the insect fauna. Both inhabit well-oxygenated waters and have a low tolerance for organic pollution (Gilpin and Brusven, 1970).

Densities of Baetis species decreased below the source area. Other macroinvertebrates observed in Nevada Spring Creek durig the summer of 1990 included chloroperlidae stoneflies, fresh water shrimp, worms, snails and planaria.

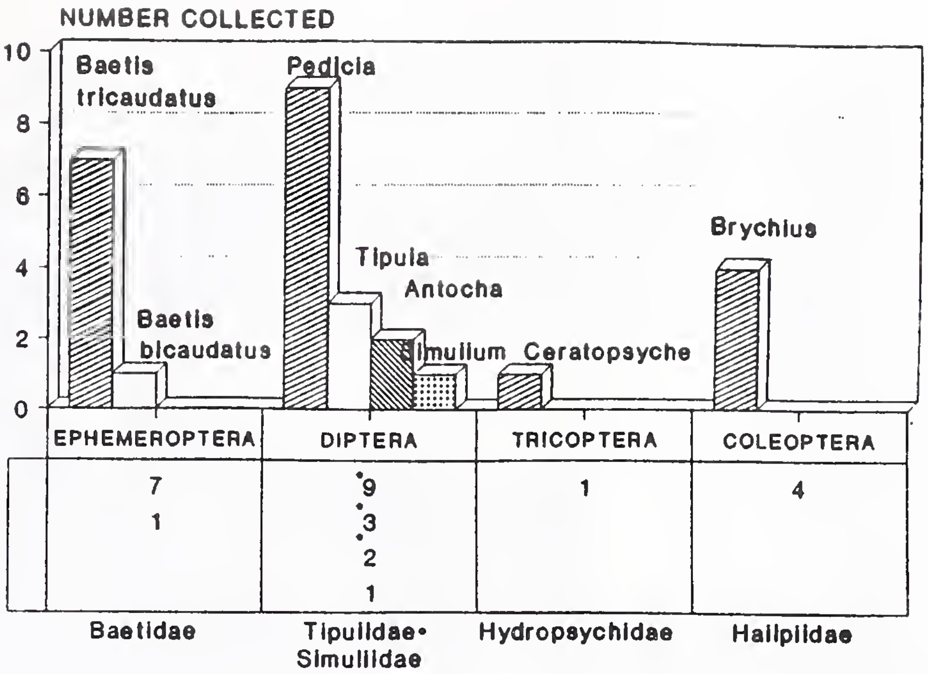


Figure 13. Insect fauna collected one-half mile below the spring source, October 1990.

STREAM TEMPERATURE STUDIES

THE BLACKFOOT RIVER AND NEVADA CREEK NEAR THE AUNT MOLLY SITE

On September 22, 1990 three continuous temperature recording devices (thermographs) were installed near the Aunt Molly fishing access site. Two were located in the Blackfoot River: one 7.9 miles downstream from the mouth of Nevada Creek at Raymond Bridge (r.m. 59.9); the second at the Cutoff Bridge (r.m. 72.4). The third was installed in Nevada Creek (mile 0.7) above its confluence with the Blackfoot River (r.m. 67.8). The thermograph at the Cutoff Bridge was the control for the study; and, the thermograph at Raymond Bridge was used to detect the thermal influence of Nevada Creek on the Blackfoot River.

Thermographs were removed on 10/16/90. All thermographs were working properly for 81 of the 117 day period. Only values derived from these 81 days were used for comparisons.

The average minimum temperature was 56.4 degrees F with an average maximum of 63.1 degrees F at the Helmville cutoff bridge. At Raymond Bridge average minimum was 59.5 and the average maximum was 64.9 or 1.8 degrees warmer than the control site at the cutoff bridge. Nevada Creek had the highest average

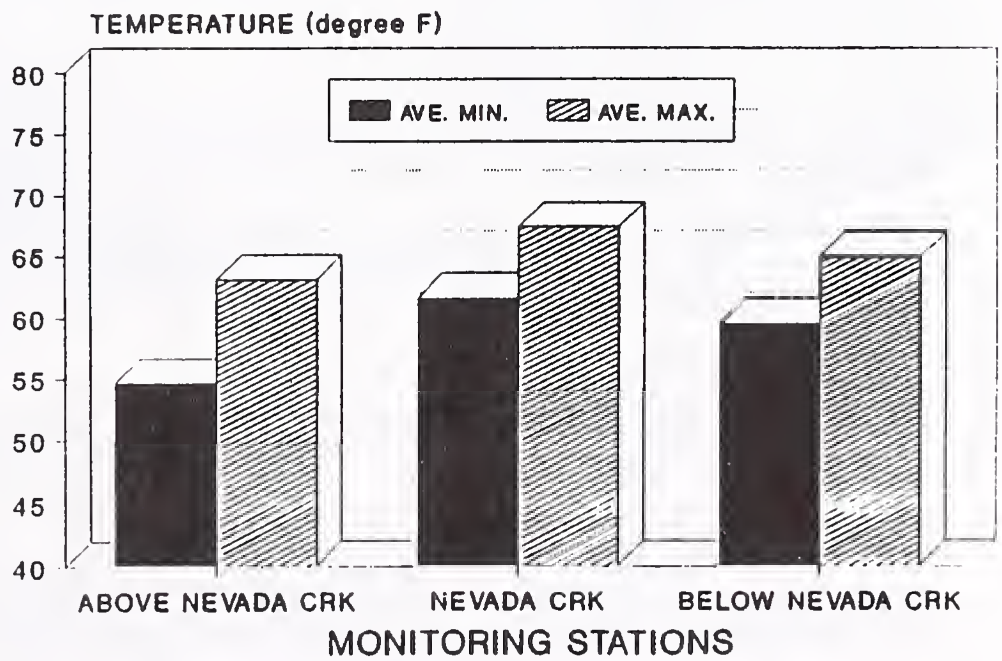
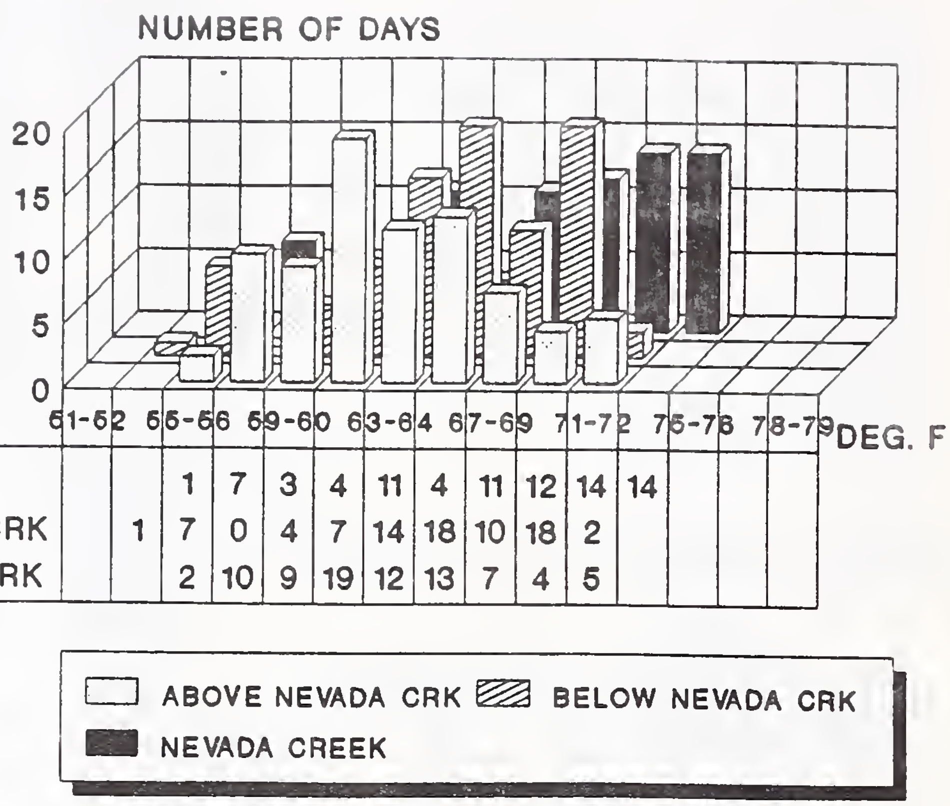


Figure 14. Average minimum and average maximum temperatures for the three monitoring sites near Aunt Molly.

minimum water temperature (61.6 degrees) and the highest average maximum water temperature (67.4 degrees F). This average maximum for Nevada Creek is 4.3 degrees F above the control and 2.5 degrees F above the temperature recorded in the Blackfoot River at Raymond Bridge. The 81 day period, maximum daily water temperatures equaled or exceeded 70 F on 37 days at Nevada Creek, 16 for the Raymond Bridge station and 6 days at the Cutoff Bridge (figure 10). Elevated stream temperatures decrease the ability of water to store oxygen. Trout have high oxygen requirements and are sensitive to both increasing temperature and corresponding decrease in oxygen. Water temperatures greater than 68 F are generally considered to be above the optimal level for salmonid growth.



NEVADA CREEK			1	7	3	4	11	4	11	12	14	14			
BELOW NEVADA CRK		1	7	0	4	7	14	18	10	18	2				
ABOVE NEVADA CRK			2	10	9	19	12	13	7	4	5				

Figure 15. Maximum stream temperatures: temperature frequency distribution

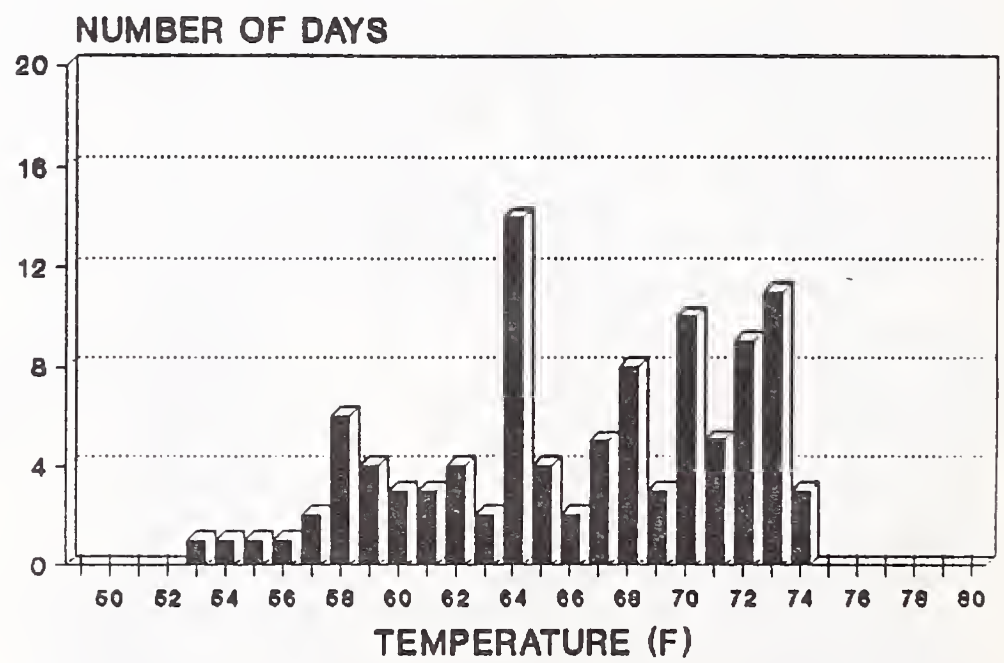


Figure 16. Maximum temperatures for Nevada Creek near the mouth, 6/22/90 - 10/1/90.

NEVADA CREEK TEMPERATURE STUDY

The Nevada Creek Thermograph worked continuously for the entire period. The data shows a high frequency of elevated stream temperatures (figure 16) for extended time periods.

NEVADA SPRING CREEK TEMPERATURE STUDY

Spot temperatures were taken throughout the summer at the source of Nevada Spring Creek. Temperatures remained a constant 44-45 degrees. A min-max thermometer located 1/2 mile below the source recorded a summer temperature range 44 to 62 degrees F.

FISHERY INVESTIGATIONS

MIDDLE REACH OF THE BLACKFOOT RIVER

Fish populations in the Blackfoot River were sampled upstream and downstream from the mouth of Nevada Creek in 1988 (figure 17). In both river sections, trout were found in very low densities. In the canyon section (r.m. 94) upstream from Nevada creek, brown trout comprised about 98% of the sample. Low densities of adult brown trout (15/1000 ft) were attributed to low numbers of juvenile trout. No estimate was obtained for YOY due to low densities. No rainbow trout were found in this slow moving section. Bull and Westslope Cutthroat trout each accounted for about 1% of the total trout catch (Peters and Spoon, 1989).

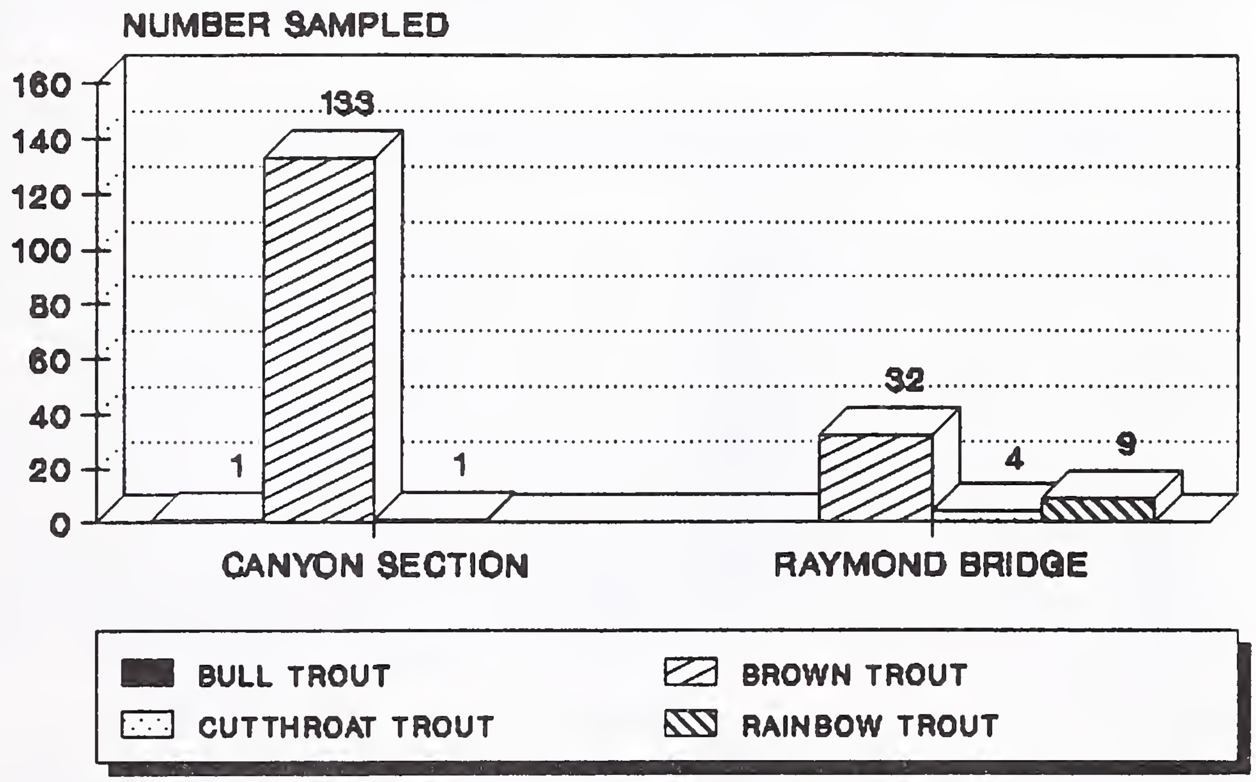


Figure 17. Trout species composition in the Blackfoot River above and below the confluence of Nevada Creek.

The confined bouldery reach between Nevada (r.m. 68) and Monture Creek (r.m. 46) supports the lowest trout densities in the Blackfoot River. Population densities for both rainbow and cutthroat trout were particularly low. A trout population estimate was attempted but not obtained after three electrofishing runs due to low population levels. Brown trout comprised 71% of the fishery based on the sample. The three sampling attempts netted 32 brown trout, 9 rainbow and 4 cutthroat trout. The low abundance of the two tributary

spawners, rainbow and cutthroat trout is suspected to be largely due to low recruitment. Low spawning success is tied to a limited number of spawning streams that enter this section of the Blackfoot River. Rock Creek, a small spring creek tributary to the North Fork, appears to provide the only source of rainbow recruits in the 22 mile river section between Nevada and Monture Creek. Conversely, brown trout tend to more successful mainstem spawners, and can provide at least a limited source of recruitment. From Nevada Creek to Monture Creek, catch-rates of brown trout young-of-the-year (YOY) averaged 0.48 fish per 10 feet of shoreline. Rainbow trout averaged 0.03/10 feet in 1988.

NEVADA CREEK

The fishery is dominated by northern squawfish, followed by coarsescale suckers, redside shiners, mountain whitefish, brown trout and rainbow trout respectively based upon electrofishing surveys. A second section surveyed 12 stream miles above the mouth produced only one longnose sucker in 200 feet of stream.

Electroshocking surveys below the reservoir (stream mile 31) in the spring 1990 sampled only 13 fish in a 400 ft section. We captured 7 coarsescale suckers, 3 juvenile rainbow trout, 2 mountain whitefish and 1 longnose sucker (figure 14). Sculpins were observed.

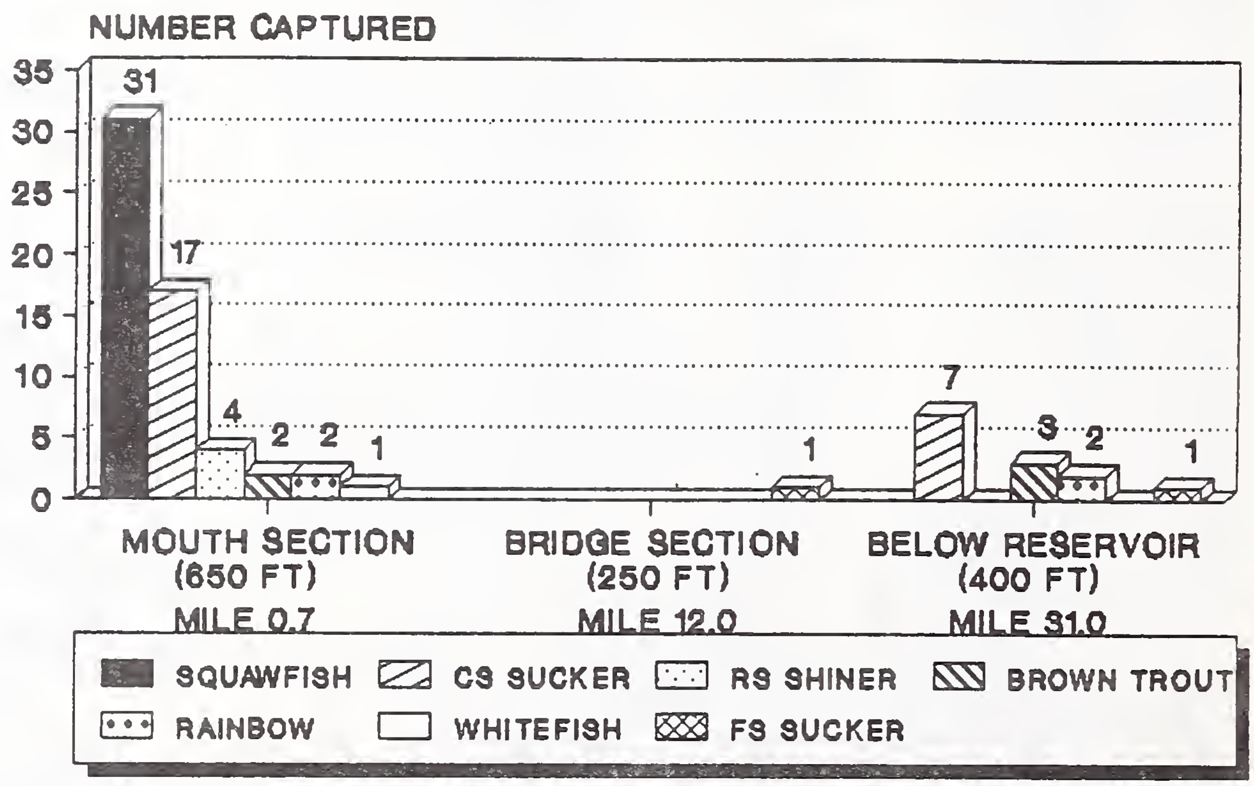


Figure 18. Species composition for three sections of Nevada Creek.

Nevada Creek from stream mile 4.0 to 0.7 was electrofished in July, 1990. We found an abundance of squawfish, coarsescale and longnose suckers and redside shiners. Of the trout species only one brown trout (11.3 inches long) was captured near stream mile 0.7. No other trout were observed.

NEVADA SPRING CREEK

Fish population surveys were completed near the spring source in April and July 1990. Brown and cutthroat trout were

captured in April 1990. Adult and juvenile (including YOY) brown trout were present, however in very low numbers. Two cutthroat were captured at the source. The estimated density of all brown trout in July, 1990 was 13 ± 1 fish per 1000 feet of stream. The estimated population for 1/2 mile of stream was 33 ± 3 fish. Coarsescale suckers were captured in low numbers; no other fish were captured nor observed during the population survey. The capture of YOY brown trout indicates successful reproduction in the upper spring creek system or closely adjoining water (figure 19). No juvenile cutthroat trout were observed in either survey and no cutthroat trout were observed during the population survey.

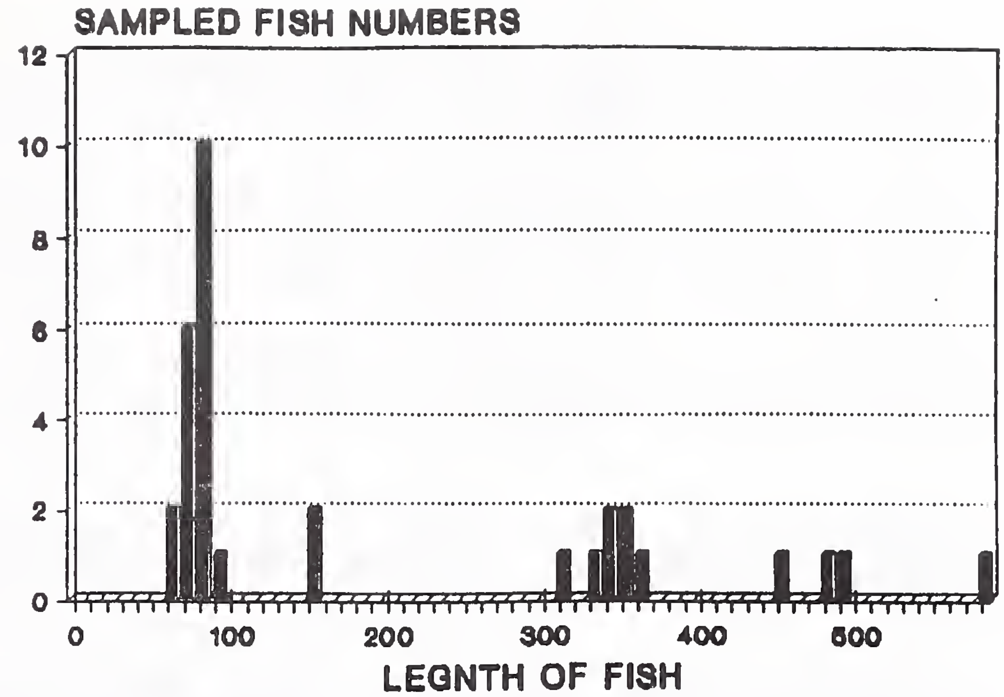


Figure 19. Length-frequency distribution for brown trout in Nevada Spring Creek.

Although Nevada Spring Creek provides spawning opportunity for resident brown trout, silted spawning gravels and poor quality rearing and adult habitats limit the current fishery. The ability of Nevada Spring Creek to reproduce cutthroat trout remains uncertain. Stream habitat improvements at the source area should help determine whether low numbers of cutthroat trout are a product of poor habitats or other factors.

WASSON CREEK

Wasson Creek is a small 1st-order basin-fed tributary to Nevada Spring Creek entering just below the spring source. The lower reach of Wasson Creek has a base flow of 1-2 cfs and receives another 3-4 cfs from a diversion of Nevada Spring Creek at stream mile 0.4. Stream discharge in July, 1990 was 4.8 cfs near the mouth. A fish population survey in July, 1990 from the mouth of Wasson Creek upstream 980 feet sampled 15 brown trout and 4 cutthroat trout. The estimated trout population was 4 cutthroat trout and 15 ± 2 brown trout per 1000 feet of stream. Except for 1 sculpin no other species were observed.

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APPENDIX

FISH SAMPLING STATISTICS

STREAM TEMPERATURES

WATER QUALITY

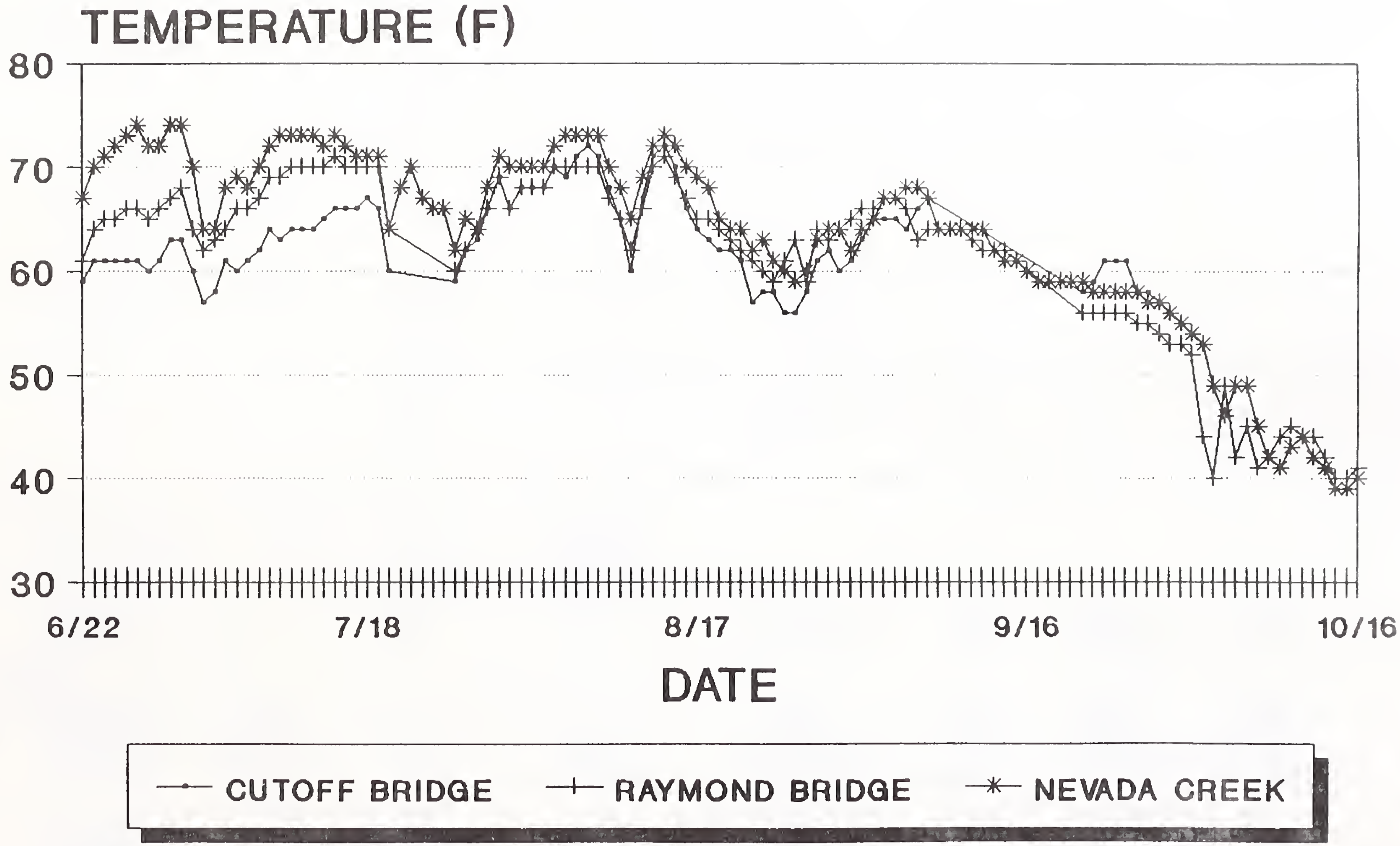
Appendix
Table 1. Catch and Size statistics for tributaries of the Blackfoot River, 1989 and 1990.

Stream (mi)	Location T R S Date	Section Length (ft)	Species	Number Captured	Range of Lengths (mm)	Average Length (mm)	Range of Weights (gm)	Average Weight (gm)
Nevada Creek								
31.0	12N 10W 11D 4/12/90	400	CSu	7	(40-468)	337	(70-1160)	627
			RB	3	(92-140)	112	(10-70)	30
			MWF	2	(295-325)	310	(310-350)	330
			FSu	1	166	166	50	50
12.0	13N 11W 14D 11/1/89	250	FSu	1	250	250	--	--
0.7	13N 11W 7D 11/1/89	650	NSF	31	(67-129)	95	--	--
			CSu	12	(98-250)	151	--	--
			RSS	6	(72-101)	84	--	--
			MWF	2	(102-108)	105	--	--
			LL	2	(109-122)	116	--	--
			RB	1	235	235	150	150
0.7-4.0	13N 11W 7D 13N 11W 8D 7/11/90	19,084	NSF	Common	--	--	--	--
			CSu	Common	--	--	--	--
			FSu	Common	--	--	--	--
			LL	1	288	288	260	260
Nevada Spring Creek								
Source	13N 11W 1D 4/12/90	600	LL	4	(158-295)	227	(40-315)	355
			CT	2	(240-245)	242	(170-200)	185
	13N 11W 1D 5/18/90	1,690	LL	26	(44-615)	323	(10-2955)	563
			CSu	1	318	318	640	640
	13N 11W 1D 7/26/90	2,000	LL	31	(58-610)	195	(10-2430)	226

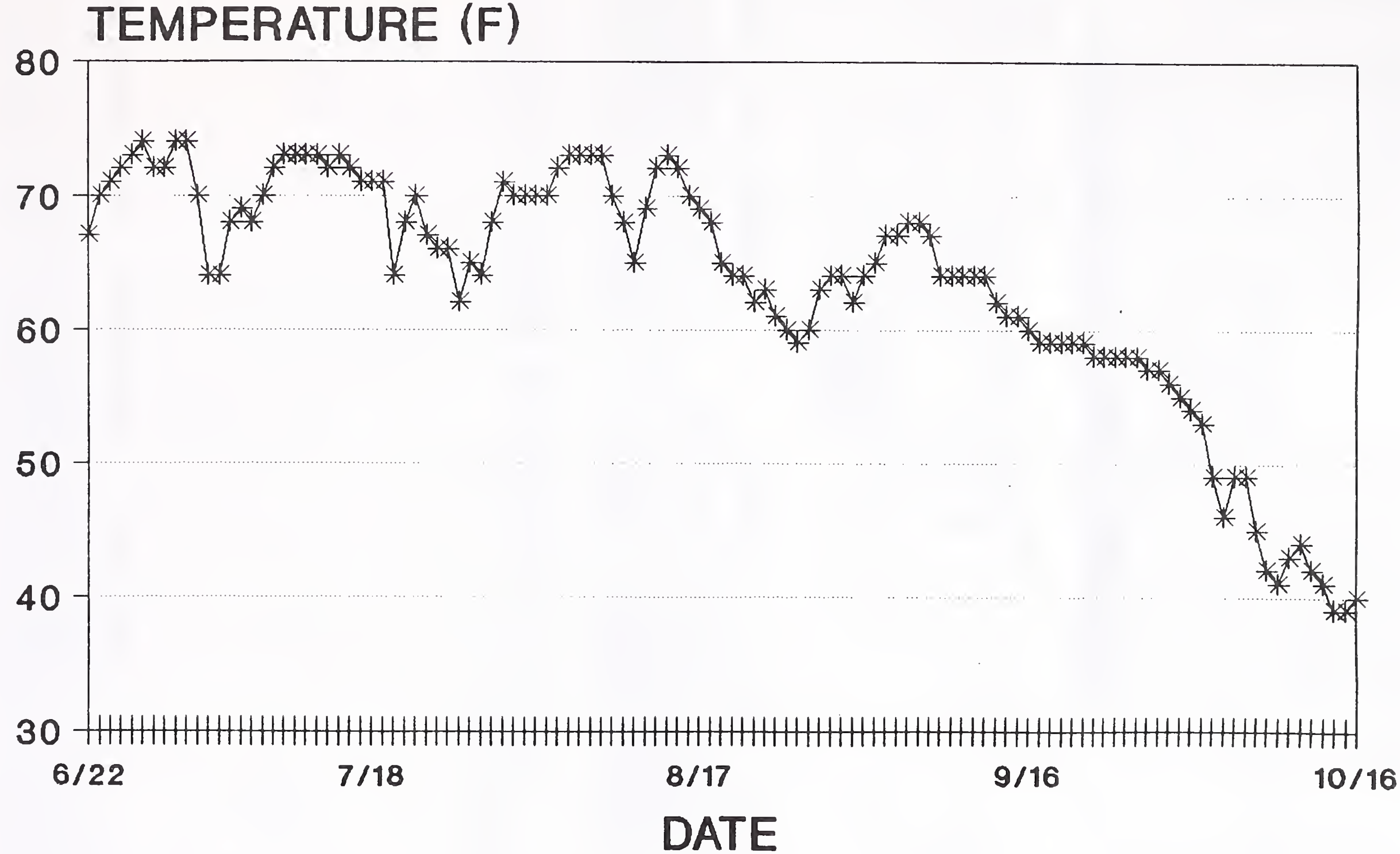
Appendix
Table 1. Catch and Size statistics for tributaries of the Blackfoot River, 1989 and 1990.

Stream (mi)	Location T R S Date	Section Length (ft)	Species	Number Captured	Range of Lengths (mm)	Average Length (mm)	Range of Weights (gm)	Average Weight (gm)
Wasson Creek								
0.2	13N 11D 1D	980	LL	14	(56-334)	183	(10-450)	154
	7/25/90		CT	4	(192-322)	266	(130-460)	272
			Sculpin	Uncommon	--	--	--	--

MAXIMUM TEMPERATURES FOR THREE STATION NEAR THE AUNT MOLLY FAS, 1990



MAXIMUM TEMPERATURES FOR NEVADA CREEK NEAR THE MOUTH, 1990



STREAM MILE 0.7

STATE HEALTH DEPT. WATER QUALITY BUREAU HELENA, MONTANA 59620

STATE	MONTANA	COUNTY	POWELL
LAT.-LONG.	465330N 1125704W	SAMPLE LOCATION	13N 11W 11DC
STATION CODE		ANALYSIS NUMBER	90W1523
DATE SAMPLED	06-01-90	DRAINAGE BASIN	076F -BLACKFOOT
TIME SAMPLED	1200	WATER FLOW RATE	10. CFS(E)
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	NOT MEASURED
SAMPLE SOURCE	SPRING	ALTITUDE OF LAND SURFACE	
WATER USE	MULTIPLE	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	DFWP	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: [redacted]

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	51.2	2.555	BICARBONATE(HCO3)	217.2	3.559
MAGNESIUM (MG)	14.4	1.185	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	7.8	0.339	CHLORIDE (CL)	1.9	0.054
POTASSIUM (K)			SULFATE (SO4)	10.6	0.221
			FLUORIDE (F)		
			PHOSPHATE(PO4 AS P)	.049	0.005
			NO3+NO2 (TOT AS N)	<.01	0.001
SUM CATIONS	73.4	4.079	SUM ANIONS	229.7	3.839

LABORATORY PH	8.50	TOT HARDNESS(MG/L-CACO3)	187
FIELD WATER TEMPERATURE (C)		TOT ALKALINITY(MG/L-CACO3)	178
SUM-DISS. IONS MEAS.(MG/L)	303.3	LABORATORY TURBIDITY (NTU)	
LAB CONDUCTIVITY-UMHOS-25C	378	SODIUM ADSORPTION RATIO	0.2

A D D I T I O N A L P A R A M E T E R S

PHOSPHOROUS,TOT (MG/L-P)	.047	AMMONIA,TOTAL(MG/L AS N)	< .01
NITROGEN,KJL,TOT(MG/L-N)	.1		

REMARKS: DFWP SURVEILLANCE MON. RESULTS TO DON PETERS,DFWP, 3201 SPURGIN RD.,MISSOULA,MT

NOTES: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

- -

SAMPLE NO-01 SAMPLER-EKP HANDLING-2100 ANALYST-LAB LAB- SCAN-NO
COMPLETED-06/18/90 COMPUTER RUN-07/13/90 DATA-0684/PGM-0984 FUND-2535
STND DEV. ION BALANCE=-1.43

	CA	MG	NA	K	CL	SO4	HCO3	CO3	NO3
MPDES-	62.6	29.0	8.3	0.0	1.4	5.8	92.8	0.0	0.0

CALC. MEQ/L= 3.831 TO 4.234 90W1523

STATE HEALTH DEPT. WATER QUALITY BUREAU HELENA, MONTANA 59620

STATE	MONTANA	COUNTY	POWELL
LAT.-LONG.	465343N 1125858W	SAMPLE LOCATION	13N 11W 10CB
STATION CODE		ANALYSIS NUMBER	90W1522
DATE SAMPLED	06-01-90	DRAINAGE BASIN	076F -BLACKFOOT
TIME SAMPLED	1230	WATER FLOW RATE	10. CFS(E)
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	NOT MEASURED
SAMPLE SOURCE	SPRING	ALTITUDE OF LAND SURFACE	
WATER USE	MULTIPLE	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	DFWP	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: [redacted]

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	42.4	2.116	BICARBONATE(HCO3)	206.2	3.379
MAGNESIUM (MG)	15.4	1.267	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	14.1	0.613	CHLORIDE (CL)	2.3	0.065
POTASSIUM (K)			SULFATE (SO4)	8.2	0.171
			FLUORIDE (F)		
			PHOSPHATE(PO4 AS P)	.037	0.004
			NO3+NO2 (TOT AS N)	.24	0.017
SUM CATIONS	71.9	3.996	SUM ANIONS	217.0	3.635

LABORATORY PH	8.44	TOT HARDNESS(MG/L-CACO3)	169
FIELD WATER TEMPERATURE (C)		TOT ALKALINITY(MG/L-CACO3)	169
SUM-DISS. IONS MEAS.(MG/L)	289.8	LABORATORY TURBIDITY (NTU)	
LAB CONDUCTIVITY-UMHOS-25C	363	SODIUM ADSORPTION RATIO	0.5

A D D I T I O N A L P A R A M E T E R S

PHOSPHOROUS,TOT (MG/L-P)	.062	AMMONIA,TOTAL(MG/L AS N)	< .01
NITROGEN,KJL,TOT(MG/L-N)	.9		

REMARKS: DFWP SURVEILLANCE MON. RESULTS TO DON PETERS,DFWP
3201 SPURGIN RD MSLA MT
NOTES: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

SAMPLE NO-02 SAMPLER-EKP HANDLING-2100 ANALYST-LAB LAB- SCAN-NO
COMPLETED-06/18/90 COMPUTER RUN-07/13/90 DATA-0684/PGM-0984 FUND-2535
STND DEV. ION BALANCE=-2.18

	CA	MG	NA	K	CL	SO4	HCO3	CO3	NO3
NPDES-	52.9	31.7	15.3	0.0	1.8	4.7	93.5	0.0	0.0

CALC. MEQ/L= 3.676 TO 4.063 90W1522